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Reference No. 19023-23

Mr. Kevin Adler
United States Environmental Protection Agency
Region V
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

SENT VIA EMAIL AND U.S. POST

Dear Mr. Adler:

Re: Response to Comments
Nitrification Study
Waukegan Manufactured Gas and Coke Plant Site
Waukegan, Illinois

This letter responds to comments made by the United States Environmental Protection Agency (USEPA) on the September 11, 2002 revised Nitrification Study Work Plan. The comments are reprinted in italics followed by a response.

USEPA Comment #1:

The work plan discusses reducing the ammonia concentration below 3 mg/L, but does not discuss other parameters. Have effluent targets been established for other parameters (i.e., COD, phenol, total nitrogen)?

CRA Response #1:

Effluent targets have not been established for other parameters. During completion of the Pilot Project Report (CRA, July 2001) and in preparing the Work Plan for the RD Nitrification Study the RD Team has determined that 3 mg/l ammonia is a necessary performance target. This determination is based on communication with other experts in the design and operation of coke plant wastewater treatment plants. The collective experience of these experts is that the nitrification process does not stabilize until the effluent ammonia concentration is 3 mg/l. Nitrification takes place after most other organics, including thiocyanates, are degraded, consequently, the remaining parameters will all be treated to low concentrations when the ammonia is reduced to 3 mg/l. This treatment phenomena was confirmed during the Pilot Project.

USEPA Comment #2:

Section 3.2, page 2, paragraph 2: This paragraph states that "nitrification is the process that will determine design kinetics and full-scale design parameters." However, the proposed testing approach monitors overall ammonia removal and conditions supporting sustained nitrification, but does not determine the specific nitrification "kinetics" needed to model the treatment process and evaluate the effect of varied cycle times or treatment volumes on nitrification performance.

CRA Response #2:

The comment correctly identifies that "design kinetics" cannot be determined from the Nitrification Study as proposed. Additional monitoring will be added to the Nitrification Study as described in response to comment 13.

USEPA Comment #3:

Section 3.2, page 3, paragraph 6. Will the 5-gallon containers be filled to the top to minimize aeration of the groundwater during shipment?

CRA Response #3:

Yes.

USEPA Comment #4:

Section 3.4.1, page 6, paragraph 3. This paragraph indicates that seed sludge from DOFSCO Steel will be diluted with supernatant or aerated tap water to obtain a concentration with the designed settling characteristics. Please explain why the dilution will not based on a target mixed liquor suspended solids (MLSS) concentration (i.e., 5000 mg/L TSS), to provide an initial MLSS concentration in the reactors similar to target operating conditions?

CRA Response #4:

This step is part of the acclimatization process. The procedure proposed was suggested by a third party expert reviewer who has used this procedure on coke plant wastewater as a means of optimizing the acclimatization process. The purpose of the acclimatization procedure proposed is to have the reactors achieve their own optimum concentration of MLSS based on the COD and ammonia concentration in the feed.

USEPA Comment #5:

Section 3.4.1, page 6, paragraph 5. The acclimatization procedure indicates that the "pH will be maintained at about 7.3 (between 7.0 and 8.5)." A tighter pH control band of 7.0 to 7.4 may be preferable, especially during the acclimatization period. Un-ionized ammonia is toxic to nitrifying bacteria. The amount of un-ionized ammonia is related to pH, with high pH giving higher un-ionized ammonia for a given total ammonia concentration. After the system is acclimated and is nitrifying, pH will not be as significant an issue.

CRA Response #5:

The seed sludge comes from a high ammonia environment and should not be adversely affected by the un-ionized ammonia at pH 8.5. During acclimatization the reactors will operate on one

feed cycle per day. The pH will be monitored and adjusted while the lab is staffed during the day but the pH may decrease during the overnight aeration. Consequently the pH will be left at the upper end of the range near the end of the working day so that it has room to fall before becoming too acidic. It should also be remembered that the mixed liquor ammonia concentration will be much less than the influent concentration.

USEPA Comment #6:

Section 3.4.1, page 7, paragraph 1. The first sentence indicates that phosphoric acid will be added as a nutrient. Micronutrients, including potassium, calcium, iron, and manganese, are important factors in biological treatment. The concentrations in the influent should be reviewed, and a supplement to provided if these parameters are not present at adequate levels.

In addition, the second sentence states "initially, about 10 ml of groundwater will be added." Clarify that this is feed to SBR-3. The operating cycle for SBR-3 is not clear; will lit operate in a simple fill and draw mode (feed, treat, settle, decant, feed?)?

CRA Response #6:

a) Micronutrients are important in biological treatment but they appeared to be present at sufficient concentration to operate the Pilot Project Treatability Study and are not expected to be a significant factor in the Nitrification Study.

b) SBR-3 is a back-up reactor. It will be fed at a reduced cycle to maintain micro-organisms on standby incase of massive failure in SBR-1 or SBR-2.

USEPA Comment #7:

Section 3.4.1, page 7, paragraph 3. Influent and effluent alkalinity should be added to the analytical list. Oxygen uptake rate (OUR) tests can also be used to measure the biomass activity and to estimate oxygen requirements for the SBR. Suggest that the OUR's be periodically measured at hourly intervals during the aeration cycle. OUR's will likely vary widely during the aeration cycle, and the maximum oxygen demand at the beginning of the aerobic cycle will need to be provided in a full-scale system.

CRA Response #7:

Alkalinity – The reactor pH will be monitored and controlled regardless of the alkalinity, consequently alkalinity measurement was not considered necessary.

OUR - While not identified in the Work Plan, it was nevertheless anticipated that several iterations of OUR will be completed after the system is optimized. The final number of OUR determination depends on the consistency and quality of the results.

USEPA Comment #8:

Section 3.4.1,l page 7, paragraphs 3 and 4. The proposed testing frequency (weekly composite) during the acclimation period for parameters other than ammonia, TSS, and nitrate appears to be low. Analysis of SCN, COD and SCOD in the effluent 3 days/week during the startup period will provide indicators of the treatment performance and whether the system is acclimating the groundwater.

CRA Response #8:

Autotrophs are the micro-organisms responsible for degradation of ammonia and are among the more sensitive micro-organisms. Hetrotrophs degrade most of the organics. The hetrotrophic degradation of organics must be taking place before nitrification will start. In fact a system that is not degrading organics will not be stable enough to start nitrification. The acclimatization effort therefore focuses on nitrification. Essentially if nitrification is working the rest of the degradation is working. Other parameters are monitored during the post acclimatization operation.

USEPA Comment #9:

Section 3.4.1, page 8, fifth bullet. The volume of water added to replace evaporation should be recorded daily along with the volume of effluent collected and sample volumes removed from the reactors.

In addition, given the significant evaporation expected from the pilot SBRs, will odors resulting from evaporation during full scale be a potential problem? If so, can the pilot program be used to provide information as to the potential severity of the problem?

CRA Response #9:

a) The volume of water added will be recorded.

b) Odors could be a problem at full-scale. Odors will be handled as a design issue.

USEPA Comment #10:

Section 3.4.2, page 9, operational parameter table. The work plan does not state whether denitrification is desired during the SBR treatment cycle. The unaerated, mixed fill period will provide conditions supporting denitrification. Denitrification returns alkalinity to the system and may also reduce the energy requirements of the treatment system by providing COD removal during anoxic stage. The table also indicates a target DO of <5 mg/L versus 3 mg/L stated in other sections. We recommend a target DO of 3 mg/L.

CRA Response #10:

Denitrification is desirable and is expected to occur. However, nitrification is the primary process objective of this study and consequently the reactors will be operated at a target DO of <5 mg/l.

USEPA Comment #11:

Section 3.4.2, page 10, paragraph 2. The third sentence states "after each HRT cycle, samples will be collected.. " Clarify this time interval. Paragraph 4 on the same page indicates that daily effluent sampling would be conducted.

In addition, please provide additional detail on the analysis of sludge for waste disposal characterization. Will the samples be analyzed for TCLP VOCs, TCLP SVOCs, TCLP metals. If the sludge is a characteristic waste is should be analyzed for other constituents for which the LDRs would apply (i.e. those constituents that may be present that have universal treatment standard limits).

CRA Response #11:

a) Paragraph 4 defines the sample collection intended. Paragraph 2 can be made consistent with paragraph 4 by deleting the words "collected and" from the second sentence of the second paragraph.

b) It is intended that the full suite of TCLP parameters be analyzed.

USEPA Comment #12:

Section 3.4.2, page 10, paragraph 3. Variations of the SBR cycle times are proposed for a three HRT period (approximately 9 days). This is a short test period for a system operating at a target SRT of 50 to 100 days. The biological system will not fully reach steady state conditions with these frequent changes in the operating cycle. Systems are often operated for 1 to 2 SRT's with set operating conditions to assess steady state operations.

CRA Response #12:

It is agreed that the schedule presented is aggressive. If unacceptable or questionable results are obtained then longer operation will be required.

USEPA Comment #13:

Section 3.4.2, page 10, paragraph 4. Analysis of a weekly composite sample will provide limited indication of a pending upset. Analysis of composite samples at least every 2 to 3 days is considered to be more typical for a treatability study.

Batch tests to develop kinetic parameters for the proposed SBR process and groundwater stream: Heterotrophic yield, maximum specific growth rate of nitrifiers, heterotrophic decay, readily biodegradable COD, anoxic growth and hydrolysis factors will provide information to allow modeling of the SBR process and subsequent reactor sizing.

CRA Response #13:

a) Frequent analysis of ammonia will measure the most sensitive part of treatment process and provide the indication of pending upset. (see response to comment 8)

b) When the treatment has been optimized during the three fill cycle per day phase of operation additional monitoring will be conducted to evaluate kinetics parameters. Six to eight samples will be collected over one cycle on three consecutive days (18 to 24 samples) and analysed for ammonia, nitrate, COD, phenols and thiocyanate.

If you have any questions regarding this matter, please do not hesitate to contact us.

Yours truly,

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